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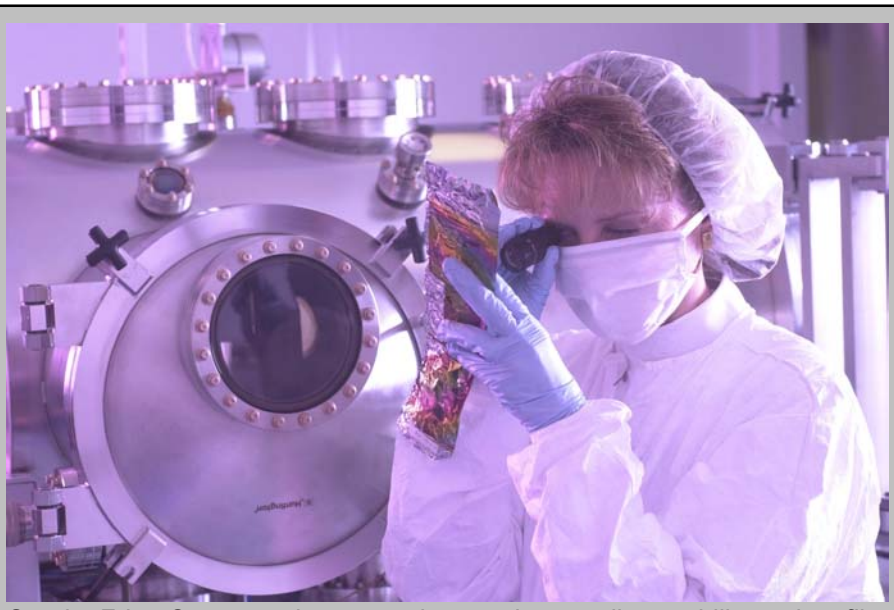
AFRL's Propulsion team doubles capacitor capabilities

by Michael Kelly, Propulsion Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — The viability of powerful directed energy weapons on future Air Force aircraft just got a shot in the arm with a greater than two-fold improvement to key electrical components that are needed to make the lasers work.

Air Force Research Laboratory Propulsion Directorate researchers involved in the developmental testing of Diamond-Like Carbon Capacitors, or DLCs, say their progress is the most significant progress made in the area of dielectrics in decades.

"Our team of scientists and engineers has enabled the production of capacitors with vastly improved energy density and temperature capabilities that are more than two times better than today's state-of-the-art capacitors," said Sandra Fries-Carr, manager for the DLC capacitor program in the Electrical Technology and Plasma Physics Branch.



Sandra Fries-Carr, a senior researcher, analyzes a diamond-like carbon film deposited on foil in the Air Force Research Laboratory Propulsion Directorate's Power Division. The DLC material is being considered for application in pulse power capacitor applications for the military. (Air Force photo)

Capacitors, which store an electrical charge, are a critical component in nearly every military and commercial high performance system, Carr pointed out. She said the improvements are crucial for airborne applications of directed energy weapons, or DEWs, because they offer considerable savings in system weight, improved electrical performance and can withstand the types of temperatures generated by the power systems feeding the lasers.

DLC has unique properties such as high temperature stability, high thermal conductivity and exceptional mechanical strength, explained Fries-Carr. "These properties make it attractive for use in advanced power management and distribution systems where temperatures above 300 degrees centigrade (approximately 570 degrees Fahrenheit) are expected.

The capabilities of these capacitors will also enable electrically driven aircraft accessories, such as engine mounted actuators, sensors and mounted flight controls for the Air Force's more electric aircraft like the Joint Strike Fighter, Fries-Carr said.

In addition to doubling the energy density and temperature capabilities of current capacitors, the team recently demonstrated continuous and uniform deposition of DLC by manufacturing a 25-foot length of the DLC capacitor film.

A collaborative effort is now underway to create an aggressive DLC technology transfer program to transition this product to the commercial sector.

The team's goal is to have a commercial product available by 2005. Scaling-up this technology will enable compact pulsed power systems for domestic applications that include utilities and appliances, well drilling equipment, power supplies, aircraft, trains, automobiles and medical devices. @